



Hydroponic cultivation training and its product processing for sustainable ecosystems in Lebakgede Area, Bandung City

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ABSTRACT

Hydroponic cultivation is considered effective and efficient in terms of time, place, and cost. Postharvest handling must also be carried out properly, such as processing vegetables and fruit in hydroponic cultivation. Therefore, hydroponic plant cultivation training activities and the processing of their products play an essential role in urban communities, especially Lebakgede Area, Bandung City. In general, this service consisted of four main stages, including preparation and planning, implementation, evaluation, and follow-up. The investigation revealed that the majority of participants were housewives (43%), followed by community institutions (29%), others (14%), and entrepreneurs and civil servants (7%). In addition, 76% of participants were extremely satisfied, understanding, and interested in practicing hydroponic cultivation and processing its products. Based on the follow-up analysis, the participants have prepared a hydroponic house that will be managed together to support the supply of food ingredients in the Lebakgede Area. This successful community service positively impacts the community by supplying high-quality vegetables. Therefore, this service activity can result in the formation of a sustainable hydroponic ecosystem and an increase in hydroponic expertise for future generations in Lebakgede Area.

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1. INTRODUCTION

Hydroponics is a method of cultivating plants with media other than soil (Ciptaningtyas et al., 2017; Purba et al., 2021). Media that can be used include red brick, rockwool, gravel, husk charcoal and so on (Perwitasari et al., 2012; Nurifah et al., 2020; Karvinaldi et al., 2022). The most crucial factor for hydroponic plants is the availability of plant fertilizer solutions. Due to the problem of land conversion, which causes agricultural land to diminish, hydroponic agricultural cultivation is becoming increasingly popular in society as a whole (Samihah et al., 2022). Hydroponic cultivation is considered effective and

efficient in terms of time and cost (Davamani et al., 2021). In addition, hydroponic plant cultivation saves space and can be carried out anywhere as long as appropriate light, water, and nutrients are provided for plant growth. The plants that can be produced from hydroponic cultivation are like lettuce (Abu-Shahba et al., 2022), spinach (Ishii et al., 2022), tomato (Naciri et al., 2022), and so on. The hydroponic system saves water because a closed system can limit water loss or evaporation. Hydroponic systems are considered useful and efficient for meeting plant water needs and saving up to 60% of water (Hidayah et al., 2021). Lately, hydroponics can also be used to create additional income for urban communities (Ariati et al., 2019; Putra et al., 2019; Rahmi et al., 2020).

In addition to hydroponic agricultural cultivation, postharvest handling, such as vegetable and fruit processing, must also be carried out appropriately. Ideally, processing fruits and vegetables produced from hydroponic cultivation can still maintain the existing nutritional content. The general technique that can be applied to processing agricultural products is known as the minimal processing method (Ahvenainen, 1996). This method is a series of treatments for fresh fruit or vegetables to remove uneaten parts and reduce the size (cutting/slicing) (Darmajana et al., 2017). These activities include washing, sorting, cleaning, peeling, and slicing, which do not affect the quality characteristics, especially the nutritional value. Due to physiological changes, enzyme activity increased respiration, and microbial activity, minimally processed fruits, and vegetables will quickly deteriorate, especially in terms of color and texture, resulting in reduced shelf life (Nanda, 2015). As a sort of community service, numerous users require hydroponic plant cultivation training and product processing procedures. Such activities will enhance awareness and comprehension of the advantages of hydroponic cultivation and effective agricultural product processing (Nanda et al., 2022).

Bandung City's Lebakgede Area is one of the possible places for this community service project. This region is urban with densely populated communities and a relatively limited allocation of land for agriculture. Therefore, using hydroponics can supply the household with vegetables by utilizing a limited area. In general, the office workers in Lebakgede Area have an average degree of activity. According to the initial study results, the residents of Lebakgede Area continue to have a strong desire to engage in gardening as a hobby or for extra revenue. People also desire organic vegetables that are fresh, healthful, and preservative-free. However, public comprehension of hydroponic cultivation and the processing of agricultural products remains extremely limited. In light of this issue, the community eagerly awaits instruction in applying hydroponic plant cultivation and processing their products. Therefore, this service aims to provide Lebakgede Area residents with training in hydroponic plant cultivation and product processing as education for sustainable production.

2. METHODS

Location

Residents of the Lebakgede Area in the City of Bandung participated in this community service project. Hydroponic agricultural cultivation instruction and processing of its products will be held on July 16, 2022, with around two weeks of preparation time (July 4-15 2022). Choosing a location in Lebakgede Area was predicated mostly on the presence of a well-established hydroponic community, even though most of its members had never received hydroponic training or participated in hydroponic product processing. Considering the facilities and infrastructure necessary to enable this community service activity, the full training was conducted at the Greenhouse DR. Hydroponics at Padjadjaran University.

Implementation of Community Service

The Community Service Team of the Faculty of Agroindustrial Technology at Padjadjaran University conducted hydroponic agricultural growing training and product processing processes to equip the community with hydroponic skills and postharvest processing techniques. Aside from that, student teams are also involved in this service as the major focus of the Real Work Lecture (KKN) course, or what is known as integrative KKN-PPM. Figure 1 depicts each stage of this community service project. This community service generally consists of four stages: (1) The preparation and planning stage; (2) The implementation stage; (3) The evaluation stage, and (4) the follow-up stage. Each of these stages will be described in depth in the following sections.



Figure 1. Stages of community service activities

Preparation and Planning Stage

The preparation and planning phase begins with providing an initial briefing to the KKN student team regarding the main scope of this community service activity. At this stage, all team members work together to equalize perceptions regarding the concept of the activities to be compiled. This is very important to minimize errors in the implementation of community service. In addition, all team members also went directly to the field to obtain more detailed information regarding the needs of the people in the Lebakgede Area.

Implementation Stage

At this stage of implementing community service, it contains a sequence of activities every time for one day. Hydroponic cultivation training and product processing start from 08.00 to 15.00 WIB. This dedication sequentially starts from opening, delivering material related to hydroponics and the product processing process, questions and answers, tours around the hydroponic area, hydroponic cultivation practices and product processing, games, and closing. In addition, the service team also prepares prizes for each participant who wins the game. This is important to increase the activity of the participants.

In the hydroponic training, the service team has prepared a hydroponic kit that the participants can assemble (Figure 2). This hydroponic kit is specifically designed for the home scale, which can be used to grow leaf vegetables (lettuce, spinach, cabbage, etc.) and fruit vegetables (chilli, tomatoes, peppers, etc.) (Dwiratna et al., 2022b). The specifications for this hydroponic kit include a water and nutrient reservoir, five buckets, 50 planting holes, and irrigation canals. In addition, the participants were also equipped with the knowledge to mix nutrients that are suitable for hydroponics.



Figure 2. Hydroponic kit for community service activities
(Source: Dr Hidroponik, 2022)

In the hydroponic product processing training, participants were trained to make salads and cold-pressed juice (Figure 3). Salad is a hydroponic processed product that contains a mixture of various vegetables and is served with sauce. Meanwhile, cold-pressed juice is a minimal processing technique for fruit and vegetables with high pressure. This technique also does not require water and sugar to maintain the vitamins and minerals.



Figure 3. Training on processing hydroponic products into salads and cold-pressed juice
(Source: Dr Healthfull, 2022)

Evaluation Stage

Evaluation of community service aims to measure the level of success of the participants in implementing hydroponic agricultural training and product processing processes. The results of this evaluation can be used as a parameter of success in achieving the objectives of this community service activity or as a basis for consideration for the continuation of further community service activities. Based on Table 1, participants must justify a numerical scale between 1 to 5 regarding the level of satisfaction, understanding, and interest in applying hydroponic agriculture and product processing. The evaluation form was given to all participants via hard copy. The higher the value of the rating scale, the more successful the implementation of this community service activity will be (Nanda et al., 2022). The final results of this evaluation will be displayed in percentage form for each question.

Table 1. Evaluation questionnaire on hydroponic cultivation training activities and product processing processes

Brief evaluation	Rating scale
Participant satisfaction level related to training	1-5
The level of understanding of participants regarding the material and practice	1-5
The level of interest of the participants regarding the application of hydroponic cultivation and product processing after attending the training	1-5

Description: Score 5 (very good), 4 (good), 3 (fair), 2 (poor), and 1 (very poor)

Follow-Up Stage

After the implementation of the training on community service has been completed, the next stage is follow-up planning. In this case, the service team will continue to monitor developments in the application of hydroponics in the Lebakgede Sub-District regularly until December 31, 2022. The implementation of this training not only focuses on conveying an understanding of hydroponics, but the service team also facilitates ordering details related to hydroponic kits. The service team is open to receiving consulting services regarding suitable hydroponic installations as needed. Complete information regarding hydroponic kit technology can be visited on the Dr. Hydroponics (<https://linktr.ee/dr.hidroponik>).

3. RESULTS AND DISCUSSION

Activity Participants

This community service activity is conducted on holidays, particularly Saturdays, to satisfy the minimum number of 15 participants. Based on the findings of the cooperation between the service team and the Lebakgede Area, most participants had a high level of enthusiasm for this training, and the number of participants exceeded the goal. Considering the various facilities and infrastructure, the total number of participants in this training was twenty. These participants will receive instructions on hydroponic cultivation, product processing, and the activity evaluation procedure.

The profession and gender of the training participants can be seen in Figure 4. Based on the results of the analysis, the professions of the participants in this training varied widely from various walks of life, including housewives, employees of non-governmental organizations, civil servants, and entrepreneurs. This proves that urban communities with various professional backgrounds have a strong interest in implementing hydroponics. The results of the analysis confirmed that most of the participants were dominated by housewives (43%), followed by community institutions (29%), others (14%), and self-employed and civil servants (7%). Therefore, this activity was dominated by women (57%) compared to men (43%).

The art of growing plants without soil is called hydroponics (Dwiratna et al., 2022a). Instead of soil, coconut fiber or wool cloth can also be used as a growing medium in a hydroponic system (Indrawati et al., 2012; Arini, 2019). Hydroponics is also a way for urban communities to keep their land green during increasingly polluted city life, less cool air, and narrow yards. Growing media, seeds, and nutrients are important aspects of hydroponics (Masduki, 2017; Sufiyanto et al., 2021). Similar to other living organisms, plants cannot grow and develop without nourishment. Providing comprehensive and constant nourishment will influence the growth and development of plants. Hydroponics is anticipated

to be a farming method that may be utilized efficiently by the Lebakgede Area community so that their yards can be utilized ideally and become a primary source of veggies for the family.

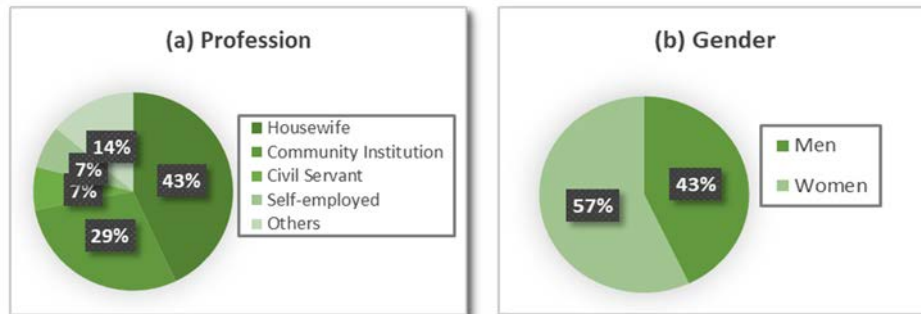


Figure 4. The diversity of the training participants, (a) profession; and (b) gender

Training Activities

This training activity begins with disseminating knowledge of fundamental hydroponic plant culture and product processing. The submission of material is accomplished by the presentation and distribution of material to each participant to facilitate comprehension. The presentation of the information lasted roughly sixty minutes, which included a question-and-answer session with the attendees. After the information presentation session, the participants were offered refreshments to prevent boredom and maintain their enthusiasm for the subsequent series of activities involving games with rewards. In addition, attendees participated in a tour of the Hydroponic DR greenhouse, which includes a hydroponic manufacturing facility, main and micro greenhouses, and a laboratory for hydroponic product processing. The tour is conducted by dividing the attendees into four groups, with one committee guiding each group. After a site tour, participants were taken through four series of practices, including hydroponic practice, hydroponic vegetable harvesting, product management, and product packaging.

As a form of gratitude from the committee to the participants who have cooperated in the training, the committee has provided four types of gifts for the participants such as DR Hydroponic T-shirts, eating and drinking utensils made from environmentally friendly materials, plant pots and storage boxes. In addition, awards in the form of plaques and certificates were also given to representatives of Lebakgede Area. The activities ended with delivering hydroponic kit grants to Lebakgede Area and filling in the evaluation rubric. Currently, hydroponic cultivation of plants is increasingly in demand because of the smaller amount of land available. The main advantage of hydroponics is that it is effective and efficient in terms of maintenance to harvest. In hydroponic techniques, postharvest handling such as vegetable and fruit processing must also be carried out appropriately. Supposedly, the processing is still able to maintain the nutritional content. Therefore, hydroponic plant cultivation training activities and the product processing process play an important role in the community, especially the Lebakgede Area.

Evaluation of Community Service Program Implementation

Evaluation is needed to measure the level of success in this community service activity. Based on the analysis, the participants generally assessed the 'very good' category for implementing this community service activity (Figure 5). This means that hydroponic training and product processing are

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considered successful and have positively impacted the community in Lebakgede Area. These positive impacts include providing a supply of quality vegetables, making the house cooler, saving expenses, saving land use, obtaining additional income, and improving the aesthetics of the scenery. On average, 76% of participants felt very satisfied, understood, and interested in implementing hydroponic cultivation and product processing. In more detail, the evaluation of participants' responses can be summarized as follows: (i) 93% of participants were very satisfied with the implementation of the training; (ii) 43% of participants could understand the material in the 'very good' and 'good' categories, and 14% in the 'fair' category; (iii) 93% of participants are very interested in implementing hydroponics. Based on the follow-up analysis, after participating in this training, the participants have prepared hydroponic houses, which will be managed jointly to support the food supply in Lebakgede Area.



Figure 5. Evaluation of participants' responses to hydroponic cultivation training and product processing with three main questions, namely: (a) The level of satisfaction; (b) The level of understanding; and (c) The level of interest in the application

Based on the analysis, the participants responded well during the training implementation. This is reflected in the active participation of the participants in each session of the event, which is shown in Figure 6. Several participants gave positive comments regarding the implementation of this hydroponics training. In addition, they also hope to be able to take part in activities like this again with more detailed topics related to hydroponics such as providing nutrition, preventing pests and diseases, and marketing hydroponic products. The biggest hope of this community service activity is forming a sustainable hydroponic ecosystem, not just for one or two people. In fact, the service team encourages all participants to pass on hydroponic skills to the next generations. And thus, the supply of food in urban areas will not experience scarcity and can even maintain consumer purchasing power.



Figure 6. Documentation of training activities

4. CONCLUSION AND RECOMMENDATIONS

This community service proposes training on the hydroponic cultivation of plants and processing their products in the Lebakgede Area. Based on the analysis, most of the participants were dominated by people who work as housewives (43%), followed by community organizations (29%), others (14%), and entrepreneurs and civil servants (7%). Based on the evaluation, this community service was considered successful and positively impacted the community in Lebakgede Area. On average, 76% of participants felt satisfied, understood, and interested in implementing hydroponic cultivation and product processing. In more detail, the evaluation of participants' responses can be summarized as follows: (1) 93% of participants were very satisfied with the implementation of the training; (2) 43% of participants could understand the material in the 'very good' and 'good' categories, and 14% in the 'fair' category; (3) 93% of participants are very interested in implementing hydroponics. And thus, this service activity can form a sustainable hydroponic ecosystem and improve hydroponic skills for the next generations. Community service activities can then be directed toward regulating the microclimate in hydroponics so that plants can grow and develop properly.

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